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Description of the surveys of portions of the south and east boundaries of the Yellowstone National Park

Albert Babbitt Bartlett

Department:

THE BARTLETT ENGINEERING CO.
MINING, CIVIL & IRRIGATION ENGINEERING
U.S. DEPUTY MINERAL SURVEYS
CHEYENNE, WYOMING

DESCRIPTION OF THE SURVEYS OF PORTIONS OF THE SOUTH AND EAST BOUNDARIES OF THE YELLOWSTONE NATIONAL PARK.

THESIS OF ALBERT B. BARTLETT
FOR DEGREE OF
ENGINEER OF MINES.
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THE BARTLETT ENGINEERING CO.
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INTRODUCTION.

The writer's Thesis presented to this school for graduation in 1907, shows that by keeping a well designed transit with solar attachment in good adjustment, the probable error of observations for meridian at proper hours of the day is close to 1' 30 ", while the average error for observations day after day is approximately 30". The greater speed attained by the use of the solar attachment over other methods of projecting lines of great length where extreme accuracy is not required, results in a selection of the solar for use in carrying on the official surveys of the U. S. Public Lands. As that Thesis goes into the technical points of the solar, it is not the intention of this Thesis to cover this ground again, but rather to give an account of the writer's experience in practical use of the solar transit in carrying on the survey of portions of the South and East Boundaries of the Yellowstone National Park, under contract with the Government, by the approval of the Secretary of the

Interior. This Thesis will be generally descriptive of the points connected with obtaining the contract under which this survey was made, the outfit necessary for the party doing the work, the personnel of the party, and the duties of each man, the engineering instruments employed in the survey, the country through which the Boundary lines run and the difficulties encountered, the writing of the field notes, and is accompanied by illustrations.

HISTORY.

By acts of Congress, based upon reports from the Lewis and Clark Expedition, and those of other explorers and trappers, the boundaries of the Yellowstone Park were defined by reference to natural objects, the East Boundary being a meridian located ten miles East of the easternmost point of Yellowstone Lake, while the West Boundary is located 15 miles west of the westernmost point of Shoshone Lake.

The first surveys were made by Lieutenant Bromwell of U.S.Engineering Corp in the early eighties. These surveys were made on the South and East Boundaries, the former being projected over the same ground covered by the contract to be described in this Thesis, and the latter for approximately its South half. Lieutentant Bromwell starting from the easternmost point of Yellowstone Lake ran east and established an Initial Monument on the East Boundary about seven and one-half miles north of where the southeast corner was subsequently set, and from this Initial Monument projected a good meridian, determined by observations on Polaris, After locating the proper position of the South Boundary, he established an Initial Monument on the same about one mile east of Yellowstone River, and projected a tangent due east and west, at its beginnning, from this Initial Monument. The Lieutenant had a large corp of assist-

ants, and ran a lane through the heavy timber and established monuments at the crest of each mountain ridge, so that from a point on Trident Mountain, a few miles east of the Initial Monument of the South Boundary, this tangent is visible with a transit and is seen at a true tangent for a distance of about 30 miles west. However, the fact that Lieutenant Bromwell did not set the monuments at each half mile, and also that his east and west line was a tangent which, as it ran further west, deviated from the true location of the east and west line which is a curve, so that by the time it reached Huckleberry Mountain, it was some five or six hundred feet south of the true location, made it necessary for a re-survey of the line.

The next surveys were made on the East Boundary by Philip M. Gallaher, U. S. Deputy Surveyor, who had a contract to make surveys of the public Forest Reservation of which the East Boundary of the Yellowstone National Park was the West Boundary. Under this contract he began at the easternmost point of Yellowstone Lake, August 3rd, 1893 by triangulation, carrying a line 10 miles east to locate the East Boundary of the Park, August 10, 1893, which he then ran north by prolonging lines by observation on Polaris, and by the use of a Young transit with Smith solar attachment, without measuring, to the intersections of the Park Boundary with the Montana-Wyoming State Line. From the intersection with the North Boundary of Wyoming, he then ran south measuring a distance of 12 miles 6.65 chains, where he

established the northwest corner of the Public Forest Reservation on August 26, 1893, and from which he ran east on the other boundaries of this reservation.

The next surveys were made by J. Milton Fowble, Assistant Engineer of the War Department in 1897. He established an Initial Monument on the West Boundary 15 miles west from the westernmost point of Shoshone Lake, and ran north taking observations on Polaris and measuring the distances, setting mile-posts at each mile and one-half mile to the 38th mile-post. He then located located the correct latitude of the North Boundary and surveyed a portion of the same.

In 1901, under contract with the Secretary of the Interior, Edward F. Stahle, U.S. Deputy Surveyor, of Cheyenne, Wyoming, made surveys of portions of the North, West and South Boundaries. Commencing July 22, 1901, on the North Boundary at the 3-mile witness corner set by Lieutenant Bromwell in 1897, he projected the North Boundary east to the intersection with the north line projected from the Gallaher survey at a point 33 miles, 13.56 chains east, setting that monument August 1, 1901. He then commenced at Fowble's 9 mile corner west and ran west on the North Boundary to 19 miles, 29.75 chains, where he established the Northwest Corner of the Park at the intersection of the North and West Boundary lines. This work was done from August 5 to August 9, 1901. On August 10, he commenced

at Fowble's 38 mile corner north on the West Boundary and ran north, setting corner monuments every one-half mile to the Northwest Corner established August 14, 1901. He then proceeded to the Initial Monument of Fowble's survey of the West Boundary and from August 22 to 27, projected that Boundary south to the point where he later established the Southwest Corner of the Park at 15 miles, 45.58 chains south from the Initial Monument. Then on August 28th, commencing at the monument set at the end of Lieutenant Bromwell's survey on the South Boundary, moving this monument 24 feet south under instructions from the department, he ran the South Boundary west to its intersection with the West Boundary, setting the Southwest Corner of the Park on September 1, 1901, at a distance of 10 miles, 21.93 chains west from the Initial Monument. In these surveys, Mr. Stahle depended entirely for his meridians upon the Smith solar attachment of a Young transit, checking his instrument upon the meridian determined by observations on Polaris at the beginning and end of each survey. Monuments were set each half mile, the distance being measured with 100-link steel tape.

In 1903 under another contract with the Secretary of the Interior, Stahle prolonged the East Boundary of the Park for 50 miles north from the Initial Monument set by Lieutenant Bromwell. Commencing on July 22 and ending August 14, making better than an average of 2 miles a day, over

some of the most mountainous country in the United States, using the same instruments and equipment as on his former surveys. On this survey, he re-ran the line formerly located by the Gallaher survey, which was found to be about one mile too far west from the true location.

Commencing south at the 50 mile corner north on the East Boundary on September 24, 1903, J. Scott Harrison, U. S. Examiner of Surveys, projected the East Boundary north to its intersection with the North Boundary at 54 miles, 41.41 chains, and he also projected the North Boundary east to its intersection with the East Boundary at 34 miles, 19.56 chains, setting witness corners for the true location of the Northeast Corner which was found to be upon a point inexcessible at that date, October 17, 1903, on account of snow and ice.

The accounts of these surveys and notes accompanying the field notes, make very interesting reading, as the different men describe many of their experiences in carrying on these surveys. Those working in such mountainous regions in the months of September and October experienced much difficulty and danger from snow and ice which covered the entire region at that season

of the year, the country being very rough and rocky, cut by deep canyons with many perpendicular cliffs, the altitude running over 8000 to 12,000 feet above sea level. The heavy blanket of timber which covers the entire country below the altitude of timber line, which is approximately 9,000 feet, made progress of the surveyors very slow and difficult. From these surveys the North Boundary is found to have a length of 53 miles 49.31 chains. The East Boundary had 54 miles, 41.41 chains of survey, leaving 7 miles, 17.67 chains to be surveyed, provided it turned out to have the same length as the West Boundary. The South Boundary had a length of 10 miles, 21.93 chains, leaving 44 miles, 13.68 chains to be surveyed allowing 66.30 chains for contingency, since the South Boundary should be that much longer than the North Boundary.

CONTRACT.

Notices were sent out from the office of the U.S. Surveyor General for Wyoming, and were advertised for proposals to execute the survey of remaining unmonumented portions of the South and East Boundaries of the Yellowstone National Park, bids to be opened on July 1, 1908. Upon opening the bids the two lowest were found to be, first by W. S. Adams, of Riverton, Wyoming, at

the rate of $44 per mile. The second by S. E. Bartlett and Albert B. Bartlett of Cheyenne, Wyoming for $45 per mile. These bids were forwarded to Washington, but owing to the fact that the lowest bids called for the payment of more money than was set aside in the appropriation by Congress for the surveys, all bids were rejected, and the contract was advertised again. At this time, the lowest bid was by Bartlett Bros. for $37.91 per mile, while that of W. S. Adams was for $40 per mile. After numerous delays, the contract was finally approved by the Secretary of the Interior on August 27, 1908, and as soon as possible thereafter, the parties started to work in the field.

THE SURVEY IN 1908.

After the approval of the contract, it was necessary for the Surveyor General to test the instrument to be used, at the meridian at Cheyenne to see if it were sufficiently accurate. In this test the instrument indicated the meridian within 1' of the true meridian, and was approved.

The party consisted of the two Deputy Surveyors and Wm. C. Perkins, an '07 graduate of the Missouri School of Mines, as chainman, W.H. Robertson, an '08 graduate of the University of Alabama as chainman, J.J.

Neville of Chicago as axeman, Frank L. Carey of Cheyenne, as axeman, and Edwin A. Robertson of Birmingham, Alabama, as flagman, and P.S. Bartlett, of Chicago, axeman.

The party went by rail over the U. P. and O.S.L. to Ashton, Idaho, the railroad point nearest to the Southwest Corner, and started from that point with a pack outfit, including a packer and cook. The first pack outfit was hired from an outfit in St. Anthony, Idaho, and turned out to be so unsatisfactory, owing to its poor equipment, small and partly broken horses and the general unsatisfactory character of the packer and cook, that after getting started from Ashton, it was decided to discharge them and they were sent back and another new outfit was hired in Ashton, getting started the next day. While waiting in Ashton the instrument was tested by observation on Polaris, and the solar was checked the next day, and in order to get the crew into practice, a line was run three miles in length returning to the starting point with an error of five links which indicated that good work could be done after the crew got in practice. The instrument was a Young light mountain transit, made almost entirely of aluminum and fitted with a Smith solar at-

tachment, which was attached to the top of the telescope, instead of on the standards in the usual way. The measurement was made by the use of a 1000 link narrow band tape, with a sleeve at each five link point stamped with the distance, and a clinometer reading to 5' of arc, in connection with this, a table of corrections being used.

Starting with a new pack outfit, we reached a point on September 3, about one-half mile from the Initial Monument on the South Boundary, from which the Stahle survey had run west 10 miles, 21.93 chains to the Southwest Corner, from which we started to run due east, to the intersection with the East Boundary, on September 4, commencing the survey at the initial Monument, which we were able to idenify by the description of the monument which was a pine post set in the ground and in a mound of stone and projecting two feet above the surface, squared to a size of 8x8 inches and scribed Y N P on the East and West faces, and S B Y.N P on the North face, and referenced by two bearing trees to which we checked the measurements and courses within about one-half link each. Also at this point, we found an enormous heavy stadia rod which had

been used by Lieutenant Bromwell on his survey and which we brought back to Cheyenne, later, as a souvenir. This rod is 13 feet long, made of heavy timber one inch thick and eight inches wide, fitted with heavy brass hinges in the middle and with a device for setting the rod up, in order not to hold it. The solar had already been tested and its adjustment found to be perfect.

The survey was then commenced and the first half mile found to be very difficult, as the line ran through dense mountain laurel, a kind of an undergrowth, attaining the height of about six to ten feet and almost impenetrable. From this point on, however, the line was fairly open and sights two or three hundred feet long could generally be taken. The method by which the survey was run, was that of determining the meridian with the solar at each setup, and prolonging the due east line in this way. Wherever a tree was found to be in line, it was marked for a line tree, and distance recorded to it, and the instrument set up directly east of the tree, and the east line determined as before. No back sights were taken except when the line ran over some mountainous region, where a sight could be taken five or ten miles back on a mountain ridge, passed over, where a check could be had on some mound or mark previously set up, as the back sight. As this could be done at each mountain ridge, the line carried on was thus

checked in a satisfactory manner. Fore sights were available in the same way.

The measurements were carried on as follows:

The head chainman would carry four pins and would follow the line carefully, stretching the tape out to its entire length through the timber and sticking one pin for each length; four lengths of the tape make one half mile., the hind chainman starting with a pin in his hand, at the starting point. After the tape had been stretched out for its entire length and the pin stuck, the hind chainman would then take a vertical angle with his clinometer, in case the tape made a straight line, but in case it had several bends in a vertical line, then the hind chainman took the vertical angle for each bend, giving an approximate length of each end within 25 or 50 links, depending upon the steepness of the slope, the hind chainman keeping a record in his note book of all distances and vertical angles, also of all features of typography crossed by the line, such as the ridges of bluffs, creeks, edges of lakes, amount of timber and edges of marshy ground, and other features necessary to show typography along the line for the purpose of establishing the same later.

At the end of each half mile, the corrections made necessary by the slope of the tape, were checked up and this correction was added to the measurement in each case, giving a true one-half mile 40 chains long.

The duties of the axemen were to blaze a line through the timber and to chop a line out so that it was possible to sight through. Under the contract, only trees within 50 links on the line were to be blazed. The method of blazing being to make two blazes on each tree, those trees near the line having blazes far apart, while those away from the line, having blazes near together. In this way when seeing a blazed tree, it could be easily told whether it is close to the line or near the 50 foot limit.

It was the duty of the flagman to keep ahead of the rest of the party and place himself on line, by motions given by the instrument man. The flagman carried a light white pole made from a lodge pole pine, being about two inches in diameter at the base and about twenty feet long. Owing to its white color, this pole was plainly visible through very dense underbrush and made a good mark for the line. As soon as the flagman was placed on line, the chainman would chain the distances up.

All the members of the party assisted in building the monuments which were as follows:

Stones not less than twenty inches long, fourteen inches wide and six inches thick, set three-fourths of their length in the ground, chiseled S B Y N P on the North face, and F R on the South face, and the numeral indicating the number of miles from the Initial Monument with the letter M on the West face. For instance, the corner 35 I/2 miles from the Initial Monument would be marked 35 I/2 M on the West. In case such stones were not available, a pine post, not less than three feet long, and six inches square could be set two feet in the ground, scribed with the same letters chiseled on the corner stones. Stones or rocks in place were available for almost all corners, there being only eight posts set for corners; one tree corner and three rocks in place used in the entire survey. At the 42 I/2 mile corner, a large pine tree occurred at the exact point for the corner and the Manual provides that in such case, the tree can be squared at the bottom and scribed with the proper letters, being witnessed properly: also where the corner falls on a rock firmly in place, this rock can be chiseled in the same manner and witnessed. Each Corner Monument had to be witnessed if possible, by four bearing trees, one in each quadrant.

Those North of the line being blazed and scribed S B Y N P 35 I/2 M, (as for instance 35 I/2 mile corner) B T while those south of the line on the same corner would be blazed and scribed F R 35 I/2 M B T. In case four bearing trees were not available within the limits of three hundred links from the corner, then bearing objects could be used, such as rocks in place, which were chiseled in the same manner, except with the letters B O instead of B T. In case the four bearing trees or objects, one in each quadrant, were not available, then as many bearings as were available were used, and in addition it was required to dig two pits each north and south of the corner stone, five feet distant, thirty-six inches square and eighteen inches deep, and a mound of earth was placed west of the corner in conical form. Where it was impossible to dig pits, a mound of stone was built instead, being conical, having a three-foot base and a height of two and one-half feet.

On the East Boundary the marks were similar, the monuments having E B YN P on the West and numeral and M on the North and F R on the East, while the bearing trees and objects on the East were marked F R with the other required markings, and those on the West with the other markings. The mounds of stone were built North of the corners. At the Southeast Corner of the

Park at the intersection of the South and East Boundary, lines, a large stone was set and chiseled S E C O R Y N P on the Northwest face and F R on the Southeast face, while four bearing trees were used, one on the Northwest face being scribed S E C O R Y N P B T , and the others F R B T.

Besides the surveying party, there were a packer Mr. John Hendricks of Marysville, Idaho, the assistant packer, Percy S. Bartlett of Chicago, Illinois, and the cook, Mr. Pete Madison of Marysville, Idaho. There were ten packhorses and three saddle horses, which were well able to handle the entire equipment. As the party proceeded in a due East line, making in the neighborhood of two miles a day, it was necessary to move camp every three or four days. The day before moving camp, two of the party would ride ahead and locate a suitable point for the next camp, being guided by maps which we had prepared for that purpose, showing the mountain ranges, streams and pack trails and also by the line which had been chopped out by Lieutenant Bromwell on his survey. In this way, the packer was able to locate camp within a short distance of the Boundary line in every case, and we had no difficulty in finding camp except twice during storms and once when the surveying party reached the point for camp before the pack outfit

arrived.

A little beyond the II mile corner, just north of the Boundary line is located the Snake River Soldier Station on the banks of Snake River, a stream about six hundred feet wide in which trout weighing up to ten pounds were very numerous. The Snake River Station is for the purpose of inspecting and registering camping parties going in and out for the Park, on the stage road between Yellowstone Park and Jacksons Hole, Wyo. At this point, the members of the party were all required to register and our fire-arms, with the exception of one 30-30 repeating rifle, according to the Park rules, were sealed. Owing to the fact that this survey was conducted under contract with the U. S. D.I. we were allowed to carry one rifle unsealed, which is rather an unusual privilege! Since that time the rules of the Park have been changed, and upon entering the Park, all fire-arms are taken away to be returned when the party leaves the Park.

From the Initial Monument to the top of Huckleberry Mountain, a little beyond the I5 mile corner, the line was always within two or three feet of twenty-four feet south of the line run by Lieutenant Bromwell, as

he had run the true East and West curve for this distance, as the line could be plainly seen to be a curve when sighting along it from the crest of Huckleberry Mountain. At this point Lieutenant Bromwell's line disappeared and we did not find it again for about three miles when it was discovered to be about four hundred feet south of our line with a course slightly north of east, it being a true tangent. Therefore the two lines converged until they were identical at a point close to 38 I/2 mile corner, where we found an old monument set by Lieutenant Bromwell, which occurred exactly on our line, and at which point the tangent of Lieutenant Bromwell's line was due east and west. From this fact we were reasonably certain that we got a very good check in alignment on Lieutenant Bromwell's survey, as we were to hit exactly on this monument, or else 24 feet south of it. In the former case, it was an exact check for a distance of 38 I/2 miles. In the latter case, the error was 24 feet in 38 I/2 miles, approximately six tenths of a foot per mile, which we considered quite satisfactory. Another good check was obtained on the line between the crest of Big Game Ridge, near the 25 I/2 mile corner and a point just east of Fox Creek near the 29 I/2 mile corner, a distance of 3 I/2

miles. Our camp was situated on the top of Big Game Ridge, and during the night we took observations on Polaris from a point on the line, and the next morning, sighted due east, the line of sight striking exactly through a small tree standing by itself in a meadow near Fox Creek. From the tables it was seen that the true east and west curve should come I2 links north of the tangent at a distance of 3 I/2 miles. The line was run from the crest of Big Game Ridge through dense timber without any fore or back sights, and upon coming out at the Fox Creek Meadows, we found our line to be II links north of the tree, the error being one link in 3 I/2 miles.

The South Boundary was run 4II/2 miles east, and then camp was moved to a point near the Initial Monument on the East Boundary, which was found by the topographic sheets and field notes of the Stahle Survey, and from this point the East Boundary was run a little over 3 I/2 miles, when the survey had to be discontinued on account of excessive snow and bad weather.

From September 24, to 27, while camped near the South Boundary, there occurred four days of snow, which was the beginning of winter, in altitudes above nine

thousand feet, as this snow never melted off. On September 28, camp was moved to the East Boundary and from September 29, to October 4, the East Boundary was run under extreme difficulties owing to the great amount of snow, the altitude of the Trident which was reached September 30, being 11,000 feet above sea level, the country being very rough and precipitous as shown by some of the illustrations. On October 2, the surveying party went to work as usual on the Trident, climbing about 3,500 feet, the elevation to camp on Mountain Creek being about 7,500, while the pack outfit moved camp to a point near the Southeast Corner of the Park. The surveying party, owing to difficulties encountered, did not get down off the Trident to the Valley of Escarpement Creek until dark, and this point was seven miles from camp. At this time a snow storm commenced and as the country was unusually rough, covered with fallen timber, and with no trails to follow, it took until 11 o'clock P.M. to make the seven miles to camp. The snow storm continued during the next morning, but stopped about noon and the party ran a short distance on the South Boundary, which was easily accessible. On the morning of October 4, the weather was somewhat threatening, but nevertheless, we began by

climbing three thousand feet to the top of the Trident, and descending I,500 feet to the Valley of Escarpement Creek from which point we intended to make a triangulation, but again were stopped by a snow storm. This storm continued all the afternoon, and the snow came down so fast that it was impossible to take a sight with a transit to make the triangulation.

The flagman had been left on line at the top of the Trident, one of the chainman had gone back to mark the 2 I/2 mile corner which left the other chainman and two axemen with the instrumentman in the Valley of Escarpement Creek. As the flagman on top of the Trident began to get frightened, we sent one of the chainmen up to stay with him and after that the storm got so bad that they both started out for camp. The three remaining in the valley waited until it was too late to try to do any more work for that day, and taking the instrument, tape, pins, axe and shovel, climbed the I,500 feet to the top of the Trident, and were unable to find the chainmen and flagman who had gone to camp. After spending considerable time hunting for them, the writer and two axemen started for camp. At this time on the top of the Trident, the elevation II,000

feet above sea level, the wind blowing a heavy snow at the rate of about fifty miles an hour, it was necessary to use a rope which had been carried for the purpose of ascending and descending cliffs, and each member of the party tied a loop of this rope around his waist in order to keep from being separated from the others.

The South side of the Trident is so steep and rough that at that time, we knew of only one place down which a descent could be made to reach camp, and in the blinding storm we were unable to locate this point, although having an instrument and a pocket compass, we knew our directions. We therefore tried different ridges and after descending a distance on each, we came to cliffs so high as to be impassable. This condition kept up until about 7:30, when darkness came on, and we were compelled to get down to timber line, where we found a few stunted trees, and built a fire at the foot of a cliff, where we stayed over night.

One of the axemen, Frank Carey, would have most certainly frozen to death, if we had not been able to get a fire started, as it was all we could do to revive

him as it was. The storm continued all night, but in the morning, cleared up for a short time, so that we were able to see, about one-half mile away, the ridge down which we were able to descend. Starting about 5 A. M. we reached camp at 10 o'clock. The storm still continued on the top of the Trident, but at the lower elevation of camp which was about 8,000 feet, it had ceased.

Knowing that the great amount of snow on the mountains would not melt off until Spring, and that it would be impossible to run lines or set corners with snow drifts, in some places at a depth of 50 feet and on the level at a depth of approximately two feet, and as the food supply was running short, with the exception of elk of which there was plenty, it was decided to abandon the surveying work, until the next season. The contract required that the survey should be finished on September 30, 1908, but owing to the delays, it was impossible to commence work soon enough to finish the survey by that time. An extension of time was applied for, and granted, allowing us until October 15, 1909, to complete the work. Commencing on the afternoon of October 5, the entire party, accom-

panied by a soldier from the Snake River Soldier Station, moved back to Marysville, Idaho, where the party was disbanded.

THE SURVEY IN 1909.

It was estimated that there still remained about seven miles to finish work on both Boundary lines, and a small party was, therefore, all that was necessary.

The members of the party included the two Deputy Surveyors, also Arthur A. Beard of Cheyenne, as chainman, Fulton C. Iredale of Rock Springs, axeman and flagman, and Godfrey Rahm of Cora, Wyoming, packer and cook. The first three named went from Cheyenne to Rock Springs by way of the U.P. Railroad and picked up Iredale at that point, and took the automobile stage, north to Pinedale, a distance of 110 miles. The scheduled time for this run was one day, but owing to the stripping of the gear, which ran the electrical apparatus, it took three days to reach Pinedale. At that point, we found the packer ready with his outfit which consisted of a heavy wagon pulled by a four-horse team, and two saddle-horses in addition. With this outfit we went north through Cora, Kendall, Wells, up

Green River through Union Pass on the Continental Divide, and down to the Post Office of Union, which is located on Wind River. From Union, we went up Wind River to its head and crossed the Cintinental Divide again at Twogwotee Pass, going from there down Black Rock Creek and reaching the forks of Buffalo Fork Creek, where the Government Bridge is located. As the wagon road runs from this point to Jacksons Lake, it was necessary to cache the wagon here, and pack over to our former camp near the Southeast Corner of the Park. It took one day to make the trip, the trail leading up the North fork of Buffalo Fork Creek, crossing the low divide to Pacific Creek, up Pacific Creek to Two-Ocean Pass, down Atlantic Creek to the point where it empties into the Yellowstone River and from there, between Hawks Rest Mountain and Bridger Lake to camp. A great deal has been written about the Two Ocean Pass, describing it as a wonderful freak of nature, but the writer has never read any description yet, which really does it justice. The great Continental Divide between the water shed, which discharges into the Atlantic Ocean, and that which discharges into the Pacific, is unusually high, rough and mountainous in

this region, in some places being so steep on top that only a mountain sheep can walk along it. At the Two Ocean Pass, however, the conditions are entirely different, and it would take an engineer with a good leveling instrument, considerable time to find the exact location of the Continental Divide. For about one-half mile the creek is continuous and apparently without current in either direction, while at one end of this one-half mile is Pacific Creek running West, and at the other end, Atlantic Creek running East. It would be a very simple matter for fish to swim across the Continental Divide.

Camp was pitched on August 23, and the next morning we started the South Boundary at the point where we had left off on October 3, of the year before, and triangulating to a point about one-half of the way up the Trident at the top of a steep cliff, we continued running the South Boundary east to the 44 mile corner, which we knew would be near the Southeast Corner of the Park. Then on August 26, taking a small amount of bedding and enough food to last us two days, we climbed to the summit of the Trident, and going back to the 2 I/2 mile corner, retraced part of the East Boundary and continued running it South.

In 1909 we had made two triangulations, one 1 1/2 miles in length, and one one mile in length, in order to carry the measurement over a cliff about 1,500 feet high on the Trident. Upon reaching the point where we had set the 2 1/2 mile corner, the year before, we found it had been carried away by the snow slide, and we could not locate its position. It was therefore necessary to make another triangulation a mile in length. After doing this, we were able to locate the point for the 2 1/2 mile corner, the three triangulations checking with each other very satisfactorily, one being 10 links difference from the other two, which gave exactly the same results.

The East Boundary was then prolonged south, the line being measured by chain as much as possible, but owing to the extreme rough and broken character of the mountains, over one-half the distance had to be triangulated.

The intersection of the two Boundaries was made and the Southeast Corner of the Park established on August 30, which completes the surveys of the Boundaries of the Yellowstone National Park.

The party then moved camp back by the same route as far as Dubois on Wind River, where the party sepa-

rated, Rahm and Iredale going back to Pinedale, and the other three, taking the stage to Lander, through the Shoshone Indian Reservation, and from Lander by rail to Cheyenne.

FIELD NOTES.

The first notes which had to be prepared, consisted of data for the U. S. Examiner of Surveys, whose duty is to go into the field and retrace enough of the surveys to satisfy himself that the survey was done according to the contract. This data consists of a map, showing the Boundaries on a scale of one inch to the mile with topography I/4 of a mile on each side of the line, showing the character of all Corner Monuments set and giving the intersections of the two Boundaries at the Southeast Corner. After receiving this information, the inspector started into the field from Cody, Wyoming and encountered snow storms to such an extent that he was unable to make an examination that season, and has put itoff until the summer of 1910.

The field notes to be filed with the Surveyor General had to be in triplicate, written up in the manner prescribed in the Manual of instructions for the

survey of Public Lands of the United States, being typewritten and bound in book form. Three plats of t the line were required, the scale being one inch to the mile, showing topography for 1/4 mile on each side of the line. These field notes are very minutely checked over by the Surveyor General's Office, and any typographical errors or other mistakes are corrected, in order that the notes may be perfectly identical. After approval, one set is kept in the Surveyor General's Office in Cheyenne, another set is kept in the General Land Office at Washington, D. C., while the third is held by the U. S. Engineer Corp of the War Department at Fort Yellowstone in the Park.

CHARACTER OF COUNTRY.

We traversed by these lines, one of the most mountainous and wild regions of the United States. The altitudes actually crossed by the lines were from 7,500 to 11,000 feet. While at a distance of about 30 miles south of the Boundary is located the Grand Teton, having an altitude of 14,700 feet, and in the Wind River and Shoshone Ranges, not far from the line, are several mountains having an altitude of 12,000 feet. Except where the country is above timber line, and except in marshy meadows along streams, the country

is covered by heavy timber which consists mostly of pine, a little spruce, balsam and pinion. The ground underneath the timber is carpeted by pine needles in whic flowers and small fruits grow in great abundance., the small fruits being wild blueberries, huckleberries, gooseberries, raspberries and strawberries. Wild game is very numerous, and hardly a day passed during which, large bands of elk were not seen, the elk being the most numerous there at the time of the year the surveys were made. Mountain sheep are plentiful, above timber line at the tops of the highest mountains, but they are so wild that we did not see any. Deer and moose are also abundant, the moose being the most easily approached of any of the wild animals, as they will let you come to within 50 or 100 yards of them when in plain view. Bear, mountain lions and wolves are also plentiful, but they did not give us much trouble, except when one night, a mountain lion treed one of our horses.

Most of the streams are full of large trout, the only exception being those streams which are above falls too high for trout to ascend. Bridger Lake, also abounds in large trout which are easily caught.

The strict rules of the Park did not permit the killing of any game or animals. Along the South Boundary of the Park from the Idaho line east to Yellowstone River, is a State Game Perserve, in which only the killing of predatory animals is permitted. Therefore, under these restrictions, our party did not kill any game until Yellowstone River had been crossed, when one of the party was fortunate enough to get a six-point bull elk.

CONCLUSION.

It is impossible to give an adequate description of the wonderful country through which these Boundary lines were run. Additional work required in making the surveys being offset by the wonders of nature to be observed on every hand. The only way to realize what this country is, is to take a trip through it.

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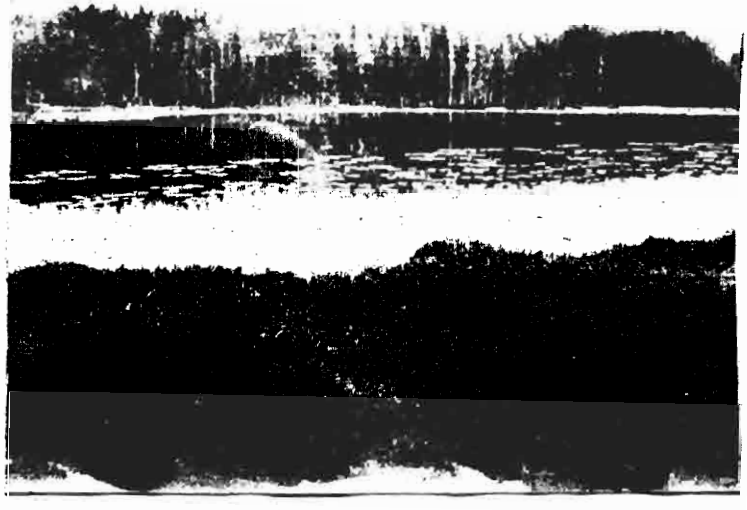

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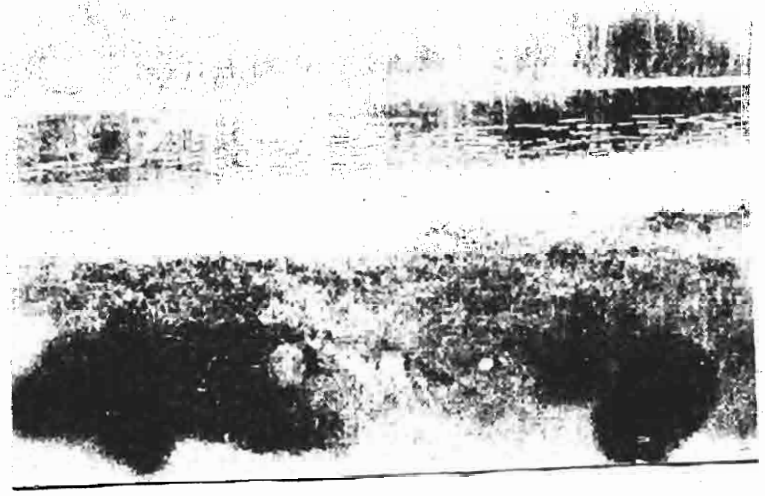

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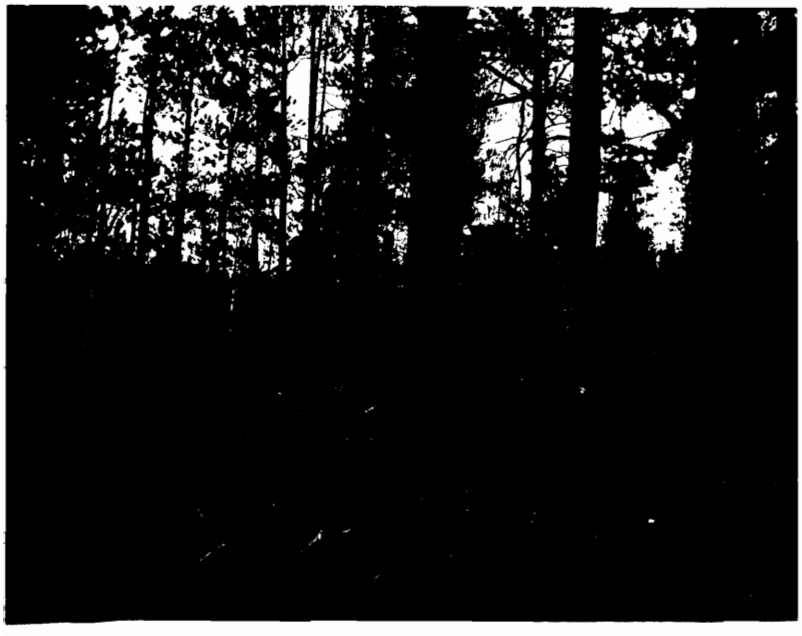

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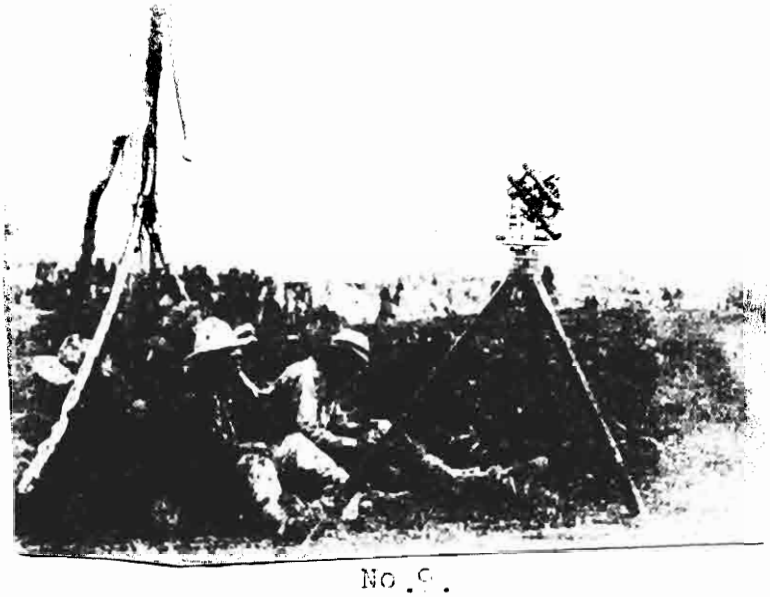

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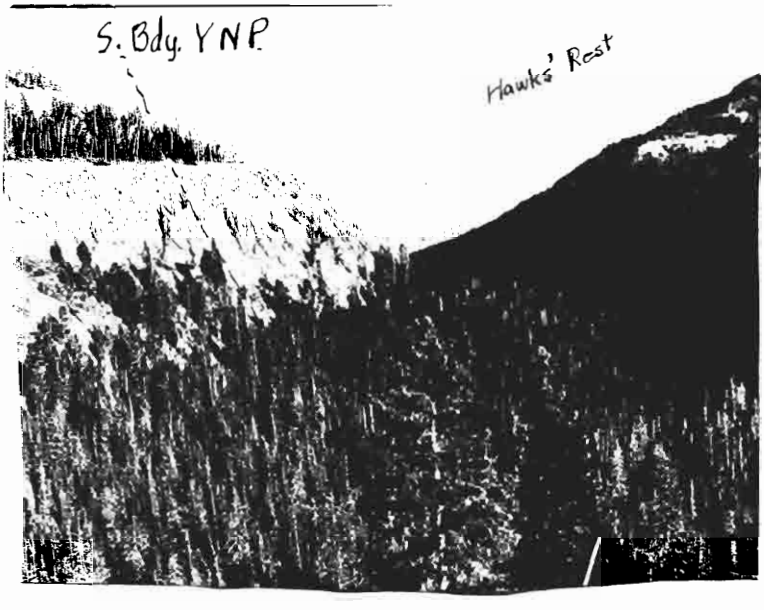

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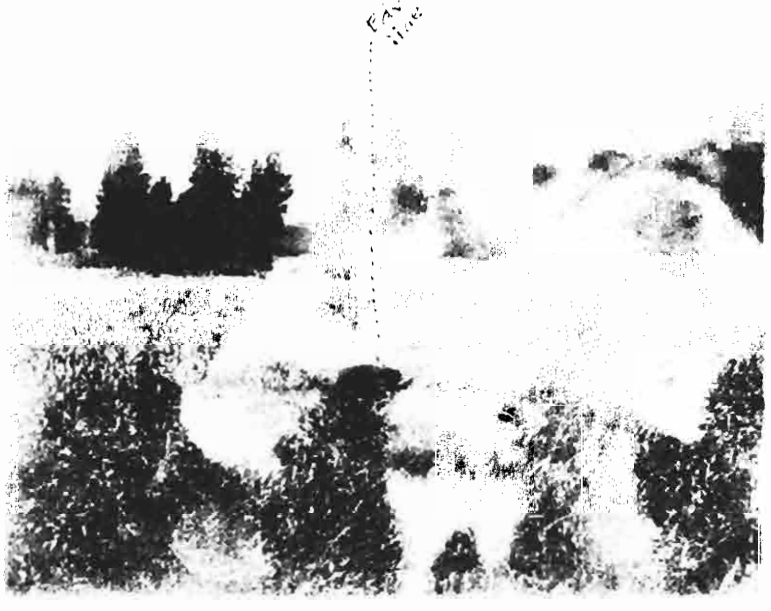

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